

CD Spectroscope

Adopted from UW-Milwaukee, Caltech.edu, and Mr. Reid from Wolseley HS

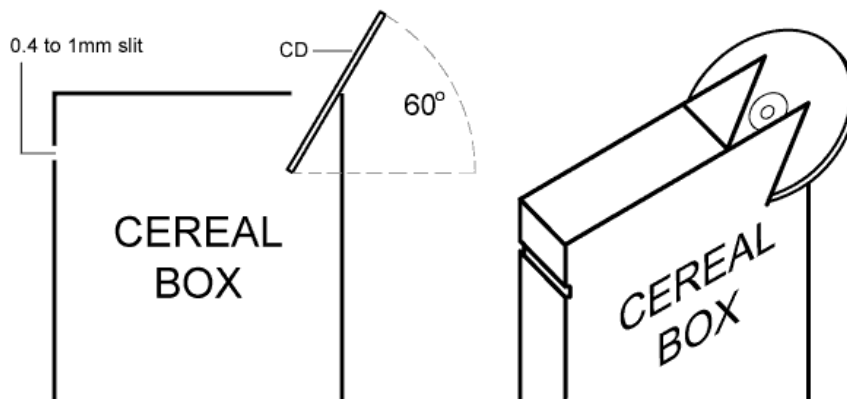
You will make a spectroscope to allow you to separate light. White light is a mixture of colors of light, and not all light that appears white is the same. Chemists make fine distinctions (nanometer $10^9\text{nm}=1\text{ m}$) between different colors because the colors of light can tell a lot about what something is made of. The composition of the sun and the atmospheres of other planets are studied by measuring colors of light produced, reflected, or absorbed. You might be surprised at what you see when you look at different light sources.

There are many experiments you can do, and ways you can modify the basic spectroscope design given here. The best part is its fun!

What you need to make a spectroscope, Materials

Old CD or DVD that you don't mind destroying,
Cereal/ cracker box or some dark heavy paper, scissors,
Glue and/or tape
Aluminum foil
Scissors, (A razor blade or sharp knife is useful, but not needed)

Visual Instructions for Constructing a “Box” CD Spectroscope



1. On the top of the box, measure in 1.5in and make a mark.
2. Using the 90 degree edge of the triangle draw a guideline across the width of the box.



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3. Cut along the guideline then unfold the flaps you just made. Cut off the flaps.



4. Place the short edge of the triangle along the top edge of the box and draw a 3 inch line towards the center of the box: Using those lines as guides...cut two 2-3" slits on both sides of the cereal box as shown, (same size for each).



5. Flip the box over and do the same thing on the other side.

6. Slide the CD or piece of CD (only the portion of the CD in the box is needed) into the slits as shown.



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7. Now you're going to cut a rectangle out on the opposite long side of the box as shown. The rectangle should be the width of the box and one inch high. The top of the rectangle should be about half an inch from the top of the box.

To cut it, first poke a hole towards the top of the box with a pen. Then, cut a rectangle using the hole as a starting point.



8. Take enough aluminum foil to cover the hole and fold it in half. Place the creased side towards the middle of the hole and tape it in place.

9. Take a second piece of foil and cover the bottom half of the hole. You want to leave a gap between the two pieces of foil. This gap should be between 0.4 and 1mm. Too wide and the spectra gets blurry. Too narrow then not enough light gets in.



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10. Tape the top of the box closed. If you would like you can add a viewing sight with a paper towel/ toilet paper role tube to the view port on top of the box you may do so, see example with Mr. Golden.



To make sure the angle is correct, hold the slit up to a light, and look through the paper tube, adjusting it until you can see the full spectrum from red to purple.

That's it! We are ready to use the spectroscope.

11. Point the slit at a light source and look into the square hole or tube.

Operations: Aim the slit of your spectroscope at the light source you are examining. Look into the spectroscope from the top of the cereal box or through the viewing tube. You should see a “rainbow” of light on the disc. It may be necessary to adjust your eye position. Take photos with your smart phone camera (flash off of course) to analyze the light in free programs such as “Learnlight Spectrometry”, Android or “SpectraSnapp”, iOS.

Alternate version (did not bring a box):

Use printed pattern, follow instructions 2x before cutting anything, assemble with glue and scissors. If you use scissors to cut the slit, it is best to cut it oversized and then narrow it with parallel strips of aluminum foil tape.

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Questions:

Make a data table on the back of this page to record your observations for the following questions, use colored pencils, crayons, etc to record what you see.

1. Try looking at an incandescent light bulb, then at a fluorescent light bulb(s), and then an LED. Describe and/or draw what you see use colors and labels. If bands are continuous indicate, if they are separated indicate.
2. Are all fluorescent lights the same?
3. Try street lights and other light sources. Describe and/or draw what you see.
4. Look at light reflected off of colored paper, or shining through transparent colored plastic, glass, or juice.
5. How does white light from a computer monitor compare to white paper?
6. Does the paper look the same under different lights?
7. Can you tell why colors look okay under some street lights and not others, despite the similar appearance of the lights themselves? (The lights look similar to your eye, but not to the spectroscope.)
8. What would happen if you widen the spectroscope slit?
9. Look at the sun's light by viewing a reflection off of concrete or white paper, Do Not Look Directly at Sun! Draw and describe.
10. Look at the moon, draw and describe.
11. Pick at least two (2) other light sources and record what you see (car HID head light, LED bulb, fire, etc.)